File Catalog: Special Purpose Electron Tubes
Section: Receiving Tubes

6900

Bendix Red Bank Type TE-54
(Generic Type 5687)

RELIABLE HARD GLASS MEDIUM MU TWIN TRIODE

(For Pulse Application)

DESCRIPTION

This miniature medium-mu twin triode is one of Bendix Red Bank "REL-G-300"* reliable vacuum tubes specifically designed for Pulse applications in missiles, aircraft and other military and industrial installations. Freedom from early failures, long average service life and uniform operating characteristics are considered prime requisites for such tubes. In addition to a 45-hour run-in under various overload, vibration and shock conditions, likely to be encountered in service, each tube is tested for its Pulse capabilities under maximum grid-drive and duty-cycle conditions.

Since this tube is designed for use in equipment with high ambient temperatures and where high levels of vibration and shock are encountered, special materials and manufacturing techniques are employed. The hard glass bulb and Tungsten stem seal construction are features found on many high-powered transmitting tubes. Careful exhaust to a high degree of vacuum, with complete out-gassing of all the elements by means of electron bombardment, as well as the usual induction heating, insures maximum life expectancy. These factors, as well as a conservative design center for cathode temperature, permit operation of the 6900 at bulb temperatures up to 300° Centigrade.

The use of ceramic spacers eliminates one of the most common sources of tube failure, which is the evolution of gas from other less costly materials, such as mica. Moreover, ceramic spacers contribute to a much sturdier structure with the use of multi-pillar supports locked together by 12 welded eyelets. Special alloy snubbers, which maintain the mount in position, retain their spring properties at high temperatures, resulting in a structure resistant to shock accelerations as high as 500 G. The rugged pure Tungsten heater is supported in a high density aluminum oxide insulator which permits operation at high Heater-Cathode voltages.

*Registered Trademark.

CHART 1. RATINGS*

Heater Voltage—(AC or DC)**	6.3 volts
Heater Current	1.00 amp.
Plate Voltage—(max.)	600 volts
Max. Peak Cathode Current***	4.5 amps.
Max. Plate Dissipation (per plate)	4.25 watts
Max. Peak Grid Voltage	±100 volts
Max. Heater-Cathode Voltage	100 ±500 volts
Max. Grid Resistance	1.0 megohm
Warm-up Time	45 sec.

(Plate and heater voltage may be applied simultaneously)

*To obtain greatest life expectancy from tube, avoid designs where the tube is subject to all maximum ratings simultaneously.

**Voltage should not fluctuate more than ±5%.

***See Chart 5.

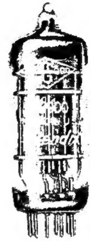

CHART 2. MECHANICAL DATA

Base	9 Pin Miniature Nonex Glass—Gold Plated Pins
Bulb	Nonex Glass—T6½
Max. Overall Length	2⅝"
Max. Seated Height	1¹⁵⁄₁₆" Nom
Max. Diameter	⅞"
Mounting Position	any
Max. Altitude	80,000 feet
Max. Bulb Temperature	300°C
Max. Impact Shock	500 G
Max. Vibrational Acceleration (100 hour shock excited fatigue test, sample basis)	50 G
Life Expectancy	5,000 hrs.

CHART 3. PULSE TEST CONDITIONS AND AVERAGE CHARACTERISTICS

Heater Voltage	6.3 volts
Heater Current	1.00 amp.
Plate Voltage	500 volts
Grid Pulse	+50 volts
Grid Voltage	−100 volts
*Plate Current	4.25 amps.
*Grid Current	0.50 amp.
Pulse Time	10 μ sec.
Pulse Repetition Rate	250 pp sec.

*Both sections paralleled (Chart 10)

Bendix
RED BANK DIVISION
AVIATION CORPORATION
EATONTOWN, NEW JERSEY

Bendix Red Bank

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ELECTRICAL CHARACTERISTICS AND TEST DATA

RT 4. TEST CONDITIONS AND CHARACTERISTICS LIMITS

All Tubes are Stabilized for 45 Hours Under Test Conditions and 2 G Vibration at 30 Cps. Prior to 100% Testing

Heater voltage, E_f .... 6.3 volts
Plate voltage, E_b .... 120 volts
Grid voltage, E_c .... —2.0 volts

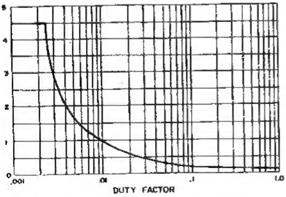
CHARACTERISTIC	SYMBOL	MIN.	DESIGN CENTER	MAX.	UNITS
PRODUCTION TESTS					
r Current	If	.950	1.000	1.050	A
r-Cathode Leakage	Ihk	—	—	25	µAdc
urrent	Ic1	—	—	1.0	µAdc
Current	Ib	25	36	47	mAdc
:onductance (1)	Sm	8000	11500	15000	µmhos
:onductance (2) Ec = 5.7	▲Sm	—	—	15	%
and Continuity					
DESIGN TESTS					
tion of Electrodes: -all = —100 Vdc all = —300 Vdc	 R R	 100 100	 — —	 — —	 meg meg
ï Plate Current = —25 Vdc Eb = 300 = —55 Vdc Eb = 500	 Ib Ib	 — 5	 — —	 2000 500	 µAdc µAdc
vated Grid Current (Ef = 7.0 V)	Ic1			5.0	µAdc
ry Plate Emission (Eb = 195 Vac)	Ib			25	µAdc
fication Factor	MU	16.0	18.5	21.0	
tion Noise Output = 120 Vdc = —2 Vdc = 2000 Frequency = 60-500~ ant Acceleration = 2.5 G	Ep	—	—	500	mVac
itance (without shield)	Cg1-p Cin Cout₁ Cout₂ CHK	2.8 5.0 0.62 0.45 2.0	— — — — —	5.2 8.8 0.98 0.77 4.0	µµf µµf µµf µµf µµf

CHART 6. ADDITIONAL TESTS

In addition to the production and design tests shown in Chart 3 other tests are performed on a sampling basis to assure a high outgoing quality level. See below.

TEST	CONDITIONS	DURATION
Heater Cycling Life Test	On 1 Min. Off 4 Min. Ef = 7.5 Ehk = 300	2,000 On-Off Cycles
Life Test	Under "Pulse Test Conditions"	500 Hours
Life "Expectancy" Test	Under "Pulse Test Conditions"	5,000 Hours
High Level Fatigue Test	2.5 G 60-500 Cycles Swept Frequency	96 Hours
Shock	500 G	20 Impacts
Altitude Test	80,000 Feet	5 Minutes
Glass Strain Test	Boiling Water to Ice Water	15 Seconds in Each
Mount Inspection	100% Test—Miscroscopic Inspection of 30 Possible Trouble Points	

RT 5. PULSE RATING



DUTY FACTOR (10,000 MICROSECOND AVERAGING TIME) FOR THE 6900 IS DEFINED AS THE RATIO OF "ON" TIME IN MICROSECONDS TO 10,000 MICROSECONDS.

ON TIME IS DEFINED AS THE SUM OF THE DURATION OF ALL INDIVIDUAL PULSES WHICH OCCUR DURING ANY 10,000 MICROSECOND INTERVAL.

CHART 7.

AVERAGE CHARACTERISTICS

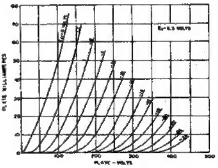


CHART 8.

AVERAGE CHARACTERISTICS (PULSE)

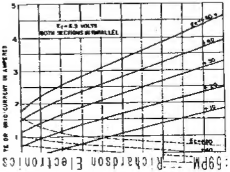


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CHART 9.

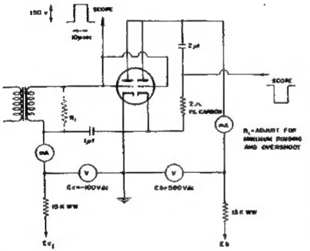
EFFECT ON LIFE OF INCREASED RATINGS (PULSE)

See also Application Notes	OPERATING CONDITIONS		
RATING OR CHARACTERISTICS	CONSERVATIVE	TYPICAL	MAXIMUM
Heater Voltage	6.3 V ± 3%	6.3 V ± 5%	6.3 V ± 10%
Plate Voltage	400 Vdc	500 Vdc	600 Vdc
Plate Current (Av.)*	10 mA	11 mA	14 mA
Plate Dissipation*	4.0 W	5.5 W	4.5 W
H-K Voltage	200 V	350 V	500 V
Grid Resistance	25,000 ohms	75,000 ohms	100,000 ohms
Bulb Temperature	200°C	250°C	300°C
Altitude	0-20,000′	60,000′	80,000′
Vibration	2 G	5 G	10 G
LIFE EXPECTANCY	MAXIMUM	HIGH	MEDIUM

*See Chart 5.

CHART 10.

PULSE TEST CIRCUIT



APPLICATION NOTES

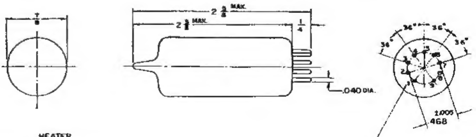
Special attention should be given to the temperatures at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy will be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.

This tube is constructed using nonex glass and thus can withstand higher ambient temperatures in operation. However, the bulb temperature should never exceed 300°C at its hottest point and cooling should be employed if necessitated by the additive effects of operation at high altitudes and high dissipation simultaneously or by other sources of heat in the equipment.

The plate voltage rating and high-perveance of the 6900 make it readily adaptable to varied pulse applications. In order to insure maximum reliability in pulse service the peak cathode current should not exceed the value shown in Chart 5 for the required duty factor.

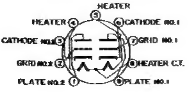
Chart 9 is presented to emphasize the dangers of operating simultaneously at or near all maxima. In general, the effect on life of operation at increased ratings is additive and cumulative. Interpolation within this chart will give the designer a general idea of the life expectancy and reliability of his application. Each proposed application should be life tested under maximum environmental conditions in order to check that the design gives the desired reliability. When conservatively used this tube has a life expectancy of 5,000 hours.

Chart 10 shows a typical Pulse Test circuit in which every 6900 is tested before shipment. Special exhaust procedures and cathode activation bring the relatively dense emission coating to a high degree of activity to maintain cathode currents under Pulse conditions with practically no "slump" during the life of the tube. The Bendix 6900 can be used with the confident expectation of superior performance in every application now using the 5687.



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

NUMBERS INDICATE PIN LOCATIONS



BASE DIAGRAM

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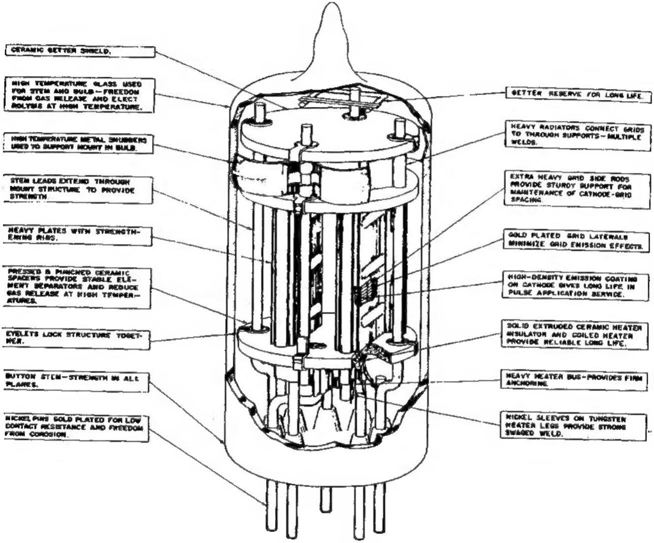


RUCTURAL FEATURES OF 6900 PROVIDE HIGH RELIABILITY AND LONG LIFE.

Bendix RED BANK DIVISION
AVIATION CORPORATION
EATONTOWN, NEW JERSEY

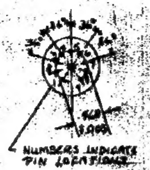
Bendix Red Bank

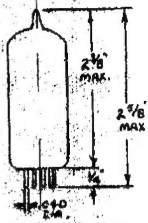
West Coast Sales & Service: 117 E. Providencia Ave., Burbank, Calif.
Export Sales & Service: Bendix International Division
205 E. 42nd St., New York 17, N
Canadian Distributor:

Base Connections:

Pin No.	1	2	3	4	5	6	7	8	9
Element	2p	2g	2k	h	h	1k	1g	hot	1p

-match
for bias, AC Balance!
DC balance!





136 x 2 = $272

Characteristics

Mechanical: 7/8" O.D., 2-5/8" max. overall length. See outline. The type 6900 electron tube is designed for use in equipment with high ambient temperatures and where high levels of vibration and shock are encountered. The tube is constructed of hard glass and uses tungsten seals, and is constructed internally using ceramic insulators and getter shield, special alloy snubbers, alumina heater-cathode insulator, gold plated grids. It is processed at high temperatures using the best power tube techniques. The tube may be used at altitudes to 60,000 feet and with bulb temperature to 250° C and vibrations up to 5 G, although maximum life is obtained when these values are held to a minimum.

$136 x 2 = $272
±3-4.5mA match!

Static:	Heater Voltage	6.3 V ± 5%
	Heater Current	1.0 Amp ± 50 ma
	Plate Voltage - 600 V max -	500 V operating & test
	Plate Current (test conditions)	36 ma
	Transconductance	11,500 ± 25%
	Amplification Factor	18.5 ± 20%
	Grid Voltage - typical -	-23 V
Dynamic:	Heater Voltage	6.3 V
	Plate Voltage	500 V
	Duty Cycle - typical -	.0025
	Pulse Width	10 usec
	Cathode Current (both sect. parallel)	4.0 A
	Grid Drive (grid-cathode volts)	+50 V
	Grid Bias	-100 V
	Plate Current Average	11.0 ma

Note: Production Testing is done under dynamic conditions. Sample tests are made at static conditions of:
Ef = 6.3 V Eb = 120 Vdc Ec = -2.0 V

PART	DESCRIPTION	MAT'L	REF.
BILL OF MATERIAL			

M U INCORPORATED
P. O. BOX 1007
2841 SAN LUIS REY RD. OCEANSIDE, CA. 92054

SPECIFICATION 6900

SCALE	DWN. BY	DWG. NO.	
✓	RAE	2-3787	
DATE	APPV. BY	REV. DATE	REV. NO.
6-25-76	[signature]	2-1-77	1